Claim 32 (amended) An accessory as defined in claim 39 in which the elastomeric pad is hollowed out by at least one vibration decay pattern modifier-free cavity to increase the kick reducing effect offered by said pad.

Cancel claim 33 without prejudice.

Cancel claim 34 without prejudice.

REMARKS:

For the most part, the changes to the specification required by the Examiner have been made. However, with respect to Section 6, page 3 of the Action, it is reference characters *65* and 66 that identify the heads of vibration decay pattern modifiers 34 and 36. Line 13 of page 9 has been corrected accordingly. Also, with respect to Section 8 of the Action, applicant has attached copies of FIGS. 6, 13, and 14 showing that reference characters 160, 201, and 203 (highlighted) do appear in these figures. (Attachment A)

With respect to Sections 2, 3, 4, and 9 of the Action, applicant has appended to this Amendment Attachment B, which contains drawing figures 3, 7, and 10-12. These figures show in red changes which applicant proposes to make in order to satisfy the Examiner's objections. The desired changes are:

FIG. 3 – relocate reference character "26" and its leadline; add reference character --46-- ; add reference characters –106 and 108—

FIG. 7 – relocate reference characters "138" and "140" and the leadlines associated with those reference characters

FIG. 10 -- change reference character "123" to -- 173 –

FIGS. 10, 11, and 12 – add reference characters – 175 and 176 –

Once the Examiner has voiced her approval of the foregoing changes, Applicant will file new formal drawings incorporating the changes.

Claims 1–3, 5 ,6, 10, 12-15, 17-25, and 35-39 are now in the application. Claims 5, 10, and 20 have been held to be directed to a non-elected invention. The rest of the just-identified claims are present for consideration by the Examiner.

Applicant has above amended independent claim 1 in a manner insuring that applicant's invention, as defined in that claim, is clearly and patentably distinct from anything disclosed in or otherwise made obvious by Johnson, the only reference applied against original claim1. Specifically, claim 1 has been amended to specify that the pad and vibration decay pattern modifier called for in that claim be made from *an organic*, elastomeric polymer. Johnson's counterpart to the thus claimed modifier is a metal coil spring. Such a component is neither organic nor an elastomer.

This distinction is clearly one of patentable importance. The Johnson device is designed to: "delay the transfer of recoil energy to the shooter." (column 1, lines 38-41) Applicant's novel accessory, in contrast, works in a quite different manner by first sharply reducing the amplitude of the initial shock wave vibrations set up when a firearm is discharged and then rapidly reducing these vibrations in a manner of only a very few milliseconds to amplitudes at which they do not cause discomfort to or otherwise affect the shooter. Furthermore, metal springs are limited in the manner in which they can dampen or otherwise affect the vibration decay pattern of vibrations imposed on the spring. For example, loads applied normal to the longitudinal axis of the spring may actually cause a Johnson spring to oscillate in a manner which increases rather than decreases the magnitude of vibrations applied to the spring. Furthermore, metal springs have only limited internal freedom of movement, which hampers the decay pattern modification ability of the Johnson spring.

In contrast, the claimed elastomeric decay pattern modifiers operate upon vibrations essentially independent of the direction from which the wave reaches the modifier, and motion of the moieties within the modifier as well as the gross motions of that component are effective to modify vibration decay patterns into a positive manner.

In conjunction with this argument that the *elastomeric* qualification patentably distinguishes applicant's claimed decay pattern modifier from the metal spring of Johnson. Applicant has attached hereto the relevant pages of THERMODYNAMIC PROPERTIES OF POLYMERS by Kathryn R. Williams. Williams is but one of many, many publications which define the term "elastomeric" (Attachment C) in similar terms. What Williams makes clear is that elastomers are not only **organic polymers** but are organic polymers which have the special physical and molecular properties identified by Williams. In no sense is a steel or other metal spring an elastomeric component.

In addition to amending claim 1 to distinguish the accessory claimed therein from Johnson, Applicant has eliminated from the last clause of claim 1 limitations not needed to patentably distinguish that claim from the Johnson reference.

In conjunction with the foregoing, newly added claim 35, which depends from claim 1, deals with the features eliminated from the parent claim as discussed above.

Claims 2, 3, 6, 12, 13, 14, 15, 17 and 21 depend from claim 1. These claims are also considered clearly patentable over Johnson. Among the reasons that these claims are so considered are those discussed above with claim 1.

As to the combination of Sims and Johnson applied against claim 2, it is applicant's position that nothing in these references suggests the subject combination and that the rejection is therefore not sustainable. Also, nothing in either reference suggests mounting the claim 2 decay pattern modifiers in the particular manner specified in that claim.

Original, independent claim 18 was also rejected as anticipated by Johnson. This claim is considered obviously patentable over Johnson by virtue of its defining sealed

pockets in the specified accessory: "that can collapse to elastically compress air filling the pocket when a [the] firearm is discharged, thus additionally, pneumatically cushioning the kick felt by the shooter upon the discharge of the firearm. Notably absent from Johnson are any pockets of this character. Such pockets would have to rely upon the integrity of stock plate 40 to close off such pockets. This, the plate does not do. Instead, any pockets in the Johnson device are deliberately vented to the ambient surroundings (see lines 25-34, column 3) and the attached copy of Johnson's FIG. 3 in which the venting channels and the manner in which they are connected to the surroundings are highlighted. (Attachment D)

Claims 19, 23, 24, and 25 are considered clearly patentable over Johnson for the same reasons that parent claim 18 is. In addition , these dependent claims are directed to an accessory which has both pneumatic vibration decay pattern modification as specified in the parent claim and modification with elastomeric decay pattern modifiers. Nothing of this character is even remotely suggested by Johnson.

In conjunction with the foregoing, Sims was combined with Johnson in the rejection of claim 24. This combination of references is believed to be improper because neither reference in any way suggests vibration decay modification with a combination of mechanisms of any sort, let alone the combination of pneumatic and elastomeric damping as required in the dependent claims.

Claim 19 is considered even further patentable over Johnson because it is directed to an accessory with *three* decay pattern modifying mechanisms, pneumatic, elastomeric, and mechanical, the latter being provided via the presence of at least one additional cavity which reduces the amount of material in the elastomeric accessory pad and thereby enhances the pad's response to shock and vibrations. Furthermore, there is no way in which the combination of Johnson and Sims would lead one to an accessory with pneumatic vibration decay pattern modification as neither reference discloses a device with this feature.

Newly presented claim 39 replaces original claim 29. Claim39 is considered clearly patentable over Johnson as nothing in that reference is a: "decay pattern modifying component having a head and an integral stem." In this regard, Sims does disclose a decay pattern of the subject configuration. However, nothing in Sims would suggest to one of ordinary skill in the art the mounting of his decay pattern modifier on the rigid plate of an accessory as defined in claim 29 or the orientation of thus mounted modifier with the head of that device disposed in the cavity of a complementary elastomeric pad.

Dependent claims 31 is considered patentable for the same reasons as parent claim 39 and because nothing in Johnson would lead one to employ an elastomeric polymer with the specific Durometer hardness called for in the claim in an accessory as defined in the parent claim. This hardness limitation is considered to be of patentable import as selection of an elastomer of the appropriate hardness is a contributing factor to the success of the claimed accessory.

Dependent claim 32 is considered patentable for the same reasons as parent claim 39 and because it contains a patentably distinguishing limitation of the character discussed above in conjunction with claim 19.

The references made of record in Section 28 of the Action but not applied to the claims have been carefully reviewed by applicant's undersigned attorney. At best, they are considered cumulative to the applied Johnson reference. For that reason and because they were not applied, they are not being discussed in detail herein. However, the undersigned is fully prepared to do so if the Examiner wishes upon receipt of a contact indicating that such discussion would be helpful.

For the reasons discussed above, it is believed that applicant has complied with all formal requirements and that the application now contains only claims which are clearly patentable over the references of record. Favorable reconsideration of the application if therefore believed to be in order and is accordingly solicited.

The amendments made above increase the number of independent claims in the application by 2. A check to cover the cost of the extra claims as well as the fee for a request for an extension of time to respond is attached.

Signed at Shelton, County of Mason, State of Washington, this 23rd day of January, 2003.

Respectfully Submitted,

STEVEN C. SIMS

By: _____

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VERSION WITH MARKINGS TO SHOW CHANGES MADE

IN THE SPECIFICATION:

Please amend paragraph 3 of page 13 as follows:

The exposed surface 56 of pad 32 has a convex shape in the transverse direction 58 with the same surface being concavely contoured in the longitudinal direction 60, falling off at toe 62, and tapering outwardly at heel 63 to conform surface 56 to the shoulder 65 of shooter 20.

Deleted: 64

Please amend paragraph 4 of page 14, line 20, and page 15 line 1 as follows:

Referring now most particularly to FIG. 7, recoil reducing accessory 120 is installed by locating its rigid plate 126 on the butt end 122 of gunstock 124; placing the elastomeric pad 128 of the accessory on butt plate 126; displacing fasteners 134 and 136 through the elastomeric pad and the rigid plate; and then threading the fasteners into the butt end 122 of gunstock 128 . The screws are tightened to hold the components of the accessory together and to secure the accessory to the gunstock.

Deleted: 135

Deleted: 124

IN THE CLAIMS:

Claim 1 (amended) An accessory for reducing the kick felt by a shooter when a firearm is discharged , said accessory comprising:

a pad, a rigid plate, and a vibration decay pattern modifier;

said pad and said decay pattern modifier both being fabricated from an organic, elastomeric material;

said pad having therein an aperture opening onto a face of the pad;

said plate being assembled in face-to-face relationship with that face of the pad onto which the aperture in the pad opens; and

the decay pattern modifier having an element which is disposed in the aperture in the elastomeric pad.

Claim 18 (amended) An accessory for reducing the kick experienced by the shooter when a firearm is discharged:

said accessory comprising a plate and a resiliently compressible kick reducing pad;

said pad having a cavity opening to one face of the pad; and

said plate being so disposed in face-to-face relationship with the pad as to close said opening and form a sealed pocket that can collapse to elastically compress air filling the pocket when the firearm is discharged, additionally, pneumatically cushioning the kick felt by the shooter upon the discharge of the firearm.

Claim 19 (amended) An accessory as defined in claim 18 which has a vibration decay pattern modifier disposed in the aperture in the pad.

Deleted: first

Deleted: integrated with the plate and a second element

Deleted: integral with the first element and is

Deleted: Claim 4 (amended) An accessory as defined in claim 1 in which the plate is: (a) configured to extend beyond the perimeters of a variety of gunstocks, and (b) machinable to match the perimeter of the plate to the perimeter of a particular firearm stock.¶

Deleted: 7. - An accessory as defined in claim 1 which includes a component for mounting the accessory to the stock of a firearm.

Deleted: ¶
8. - An accessory as defined in claim 7 in which the accessory mounting component is a threaded fastener.

Deleted: 9. . An accessory as defined in claim 8:¶
which includes a rigid mounting plate;¶
said mounting plate being embedded in said pad and providing a mechanism for supporting the threaded fastener.

Deleted: 11. - An accessory as defined in claim 1 wherein the pad aperture in which the second element of the vibration decay pattern modifier is disposed is so sealed that said pad provides pneumatic cushioning when the firearm is discharged.

Deleted: 16. - An accessory as defined in claim 15 in which there are cavities in the elastomeric pad which reduce the thickness of the pad material and thereby contribute to the compressibility of the pad.

Deleted: thus

Deleted: 7

Deleted: integrated with said plate and

Claim 22 (amended) An accessory as defined in claim 19 in which there is an additional, sealed decay pattern modifier-free cavity in said pad further contributing to the cushioning afforded by the accessory when the firearm is discharged.

Claim 23 (amended) An accessory as defined in claim 22 in which said additional cavity extends completely through said pad and accommodates a fastener designed to secure the accessory to the gunstock.

Claim 24 (amended) An accessory as defined in claim 18;

which comprises a vibration decay pattern modifier

said modifier having a mushroom-like configuration defined by a stem and an integral head;

said stem being fixed to said plate; and

said head being disposed in the cavity in the resiliently compressible pad.

Claim 25 (amended) An accessory as defined in claim 24 in which there is a clearance around the periphery of the decay pattern modifier head between that periphery and the boundary of the compressible pad aperture in which said element is disposed.

30. An accessory as defined in claim 39 in which said elastomeric pad, or said decay pattern modifying component, or said pad and said component are fabricated from a material which comprises a chloroprene polymer.

Deleted: 20. - An accessory as defined in claim 18 in which:¶
said plate has a base and a wall extending around the periphery of the base and oriented at right angles to said base; and¶
said base and said plate are so sealed together around said periphery as to confine air to the cavity in the base and thereby impart said pneumatic cushioning function to the accessory.¶

Deleted: 21. - An accessory as defined in claim 17 in which said cavity is so dimensioned as to reduce the thickness of accessory material and thereby increase the cushioning afforded by said pad when the firearm is discharged.

Deleted: 20

Deleted: for also reducing the thickness of elastomeric pad material and thereby

Deleted: 1

Deleted: 7

Deleted: 3

Deleted: 26. - An accessory as defined in claim 17 in which the decay pattern modifier, the compressible pad, or the decay pattern modifier and the compressible pad are fabricated from a material which comprises a chloroprene polymer.¶
¶
27. - An accessory as defined in claim 17 in which said material has a Durometer hardness in the range of 12 to 30.

Deleted: 28. - An accessory for reducing the kick felt by the shooter when a firearm is discharged, said accessory comprising:¶
a generally rigid plate; and¶
an elastomeric pad fixed in face-to-face relationship to said plate.

Deleted: 29. - An accessory as defined in claim 28:¶
which comprises a component for modifying the decay pattern of vibrations set up in the accessory when the firearm is discharged;¶
said decay pattern modifying component having a head and an integral stem; ¶
said stem being attached to said plate;¶
there being a cavity in said elastomeric pad; and¶
the head of the decay pattern modifying component being disposed in said cavity.¶

Deleted: 22

31. An accessory as defined in claim 39 in which the material has a Durometer hardness in the range of 12 to 30.

Deleted: 23

Claim 32 (amended) An accessory as defined in claim 39 in which the elastomeric pad is hollowed out by at least one vibration decay pattern modifier-free cavity to increase the kick reducing effect offered by said pad.

Deleted: 28

sub E1

Deleted: 33. - An accessory as defined in claim 32 which:¶
comprises a component for modifying the decay pattern of the vibrations set up in the gun when said gun is discharged;¶
said component being disposed in a cavity in said elastomeric pad; and¶
said cavity being one of the features which hollow out said pad.¶
34. - An accessory as defined in claim 33 which:¶
Includes an additional cavity in said pad which contributes to the hollowing out of the pad;¶
there being a fastener for attaching the accessory to the butt end of a gunstock and accessory aperture through which the fastener extends; and¶
there being a cavity in line between segments of the accessory aperture which contributes to the hollowing out of the elastomeric pad.

35 An accessory as defined in claim 1 in which the decay pattern modifier has a second element which is integral with the first element, the second element being integrated with the plate.

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36. The combination of:

an accessory as defined claim 1;

a firearm which has a stock;

threaded fasteners for: (a) maintaining the elastomeric pad and the plate of the accessory in assembled relationship, and (b) mounting the accessory to the stock of a firearm; and

a rigid mounting plate;

said mounting plate being embedded in said pad and providing a mechanism for supporting the threaded fastener.

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37. An accessory for reducing the kick felt by a shooter when a firearm is discharged, said accessory comprising:

a pad, a rigid plate, and a vibration decay pattern modifier;

said pad and said decay pattern modifier both being fabricated from an organic, elastomeric material;

said pad having therein an aperture opening onto a face of the pad;

said plate being assembled in face-to-face relationship with the face of the pad onto which the aperture in the pad opens; and

the decay pattern modifier having an element plate which is disposed in the aperture in the elastomeric pad; and

the pad aperture in which the element of the vibration decay pattern modifier is disposed being so sealed that said pad provides pneumatic cushioning when the firearm is discharged.

38. An accessory for reducing the kick felt by a shooter when a firearm is discharged, said accessory comprising:

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a pad, a rigid plate, and a vibration decay pattern modifier,

said pad and said decay pattern modifier both being fabricated from an organic, elastomeric material;

said pad having therein an aperture opening onto a face of the pad;

said plate being assembled in face-to-face relationship with that face of the pad onto which the aperture in the pad opens;

the decay pattern modifier having an element which is disposed in the aperture in the elastomeric pad; and

there being at least one additional cavity in the elastomeric pad which reduce, the thickness of the pad material and thereby contribute to the compressibility of the pad.

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39. An accessory for reducing the kick felt by the shooter when a firearm is discharged, said accessory comprising:

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a generally rigid plate;

an elastomeric pad fixed in face-to-face relationship to said plate; and

a component for modifying the decay pattern of vibrations set up in the accessory when the firearm is discharged;

said decay pattern modifying component having a head and an integral stem;

said stem being attached to said plate;

there being a cavity in said elastomeric pad; and

the head of the decay pattern modifying component being disposed in said cavity

ATTACHMENT C

THERMODYNAMIC PROPERTIES OF ELASTOMERS

by Kathryn R. Williams

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1. Introduction

Rubber objects are common in daily life, and everyone is familiar with at least some of the physical properties of the class of polymers called elastomers:

1) They are capable of being stretched to several times their original length with relatively little applied force.

2) When the force is released they retract rapidly to the unstressed length (property of snap or rebound). The heat transfer on rebound is very close to zero.

3) They suffer no permanent deformation as a result of the extension process (property of resilience).

4) When they are fully elongated (or nearly so), they exhibit very high tensile strengths and stiffness (modulus).

The properties described above are all observable on the macroscopic level, which is the realm of classical thermodynamics. The classical treatment requires no knowledge or assumptions of molecular structure. However, in order to exhibit such behavior, the polymer must have certain molecular properties:

1) The polymer must have a large molecular weight, with, for the most part, very weak interactions between chains. For example, natural rubber, which is also called *Hevea* rubber after its source as the sap of the *Hevea brasiliensis* tree, has a molecular weight of about 350,000. Its chemical composition is poly(cisisoprene) (Figure 1), which in the untreated material has only weak intermolecular forces.

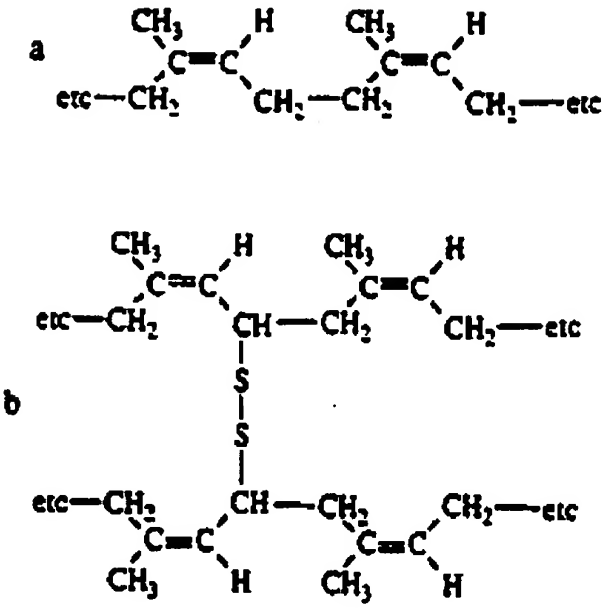

Figure 1. Structure of natural rubber a) before and b) a vulcanization to introduce disulfide cross-links.

2) The polymer must be amorphous (i.e., noncrystalline) and must be above its glass transition temperature, Tg. The Tg is the temperature, or range of temperatures, over which the polymer exhibits a marked change in several physical properties, most notably specific volume, thermal coefficient of expansion, specific heat capacity, and refractive index. Below the Tg, there may be small local rotations (e.g., rotation around the C-C bond to a side-chain methyl group), but the polymer chains themselves are frozen into fixed positions (albeit not in a regular crystalline array), and the polymer is a hard, brittle glass. Above the glass transition temperature, the thermal energy is sufficient to allow rotations and limited translations of large segments of the polymer chain. On the macroscopic scale the polymer has the dimensional constancy of a solid, but on the molecular level the chain segments exhibit liquid-like properties.

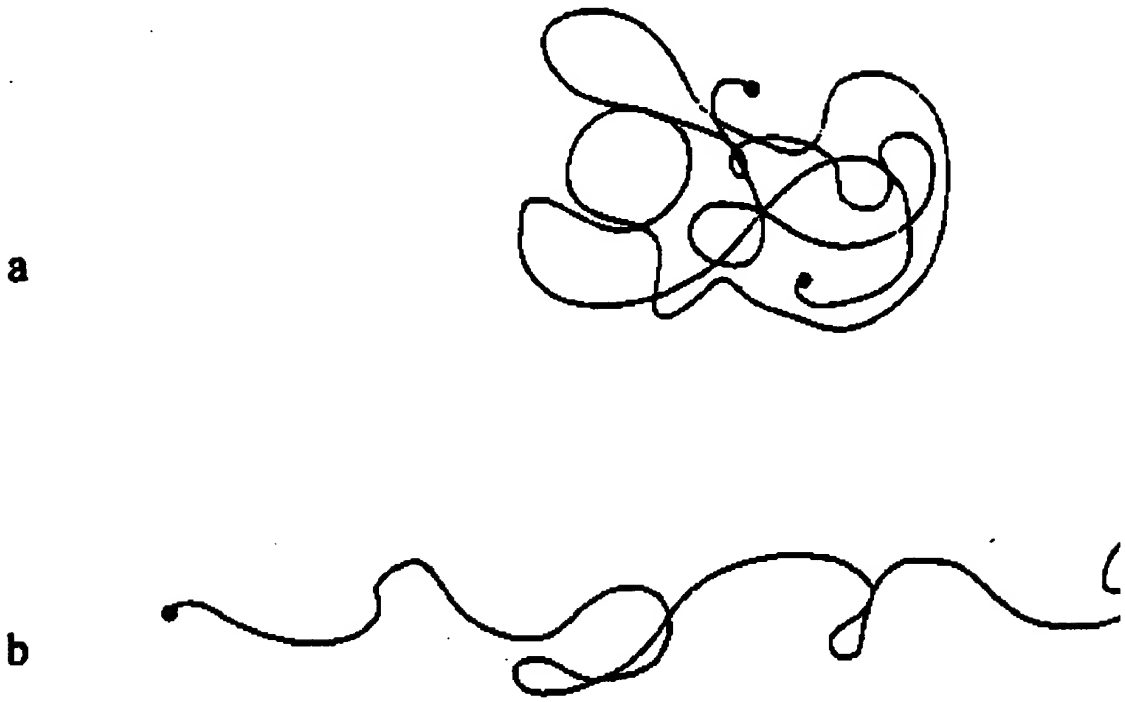

Figure 2. Representation of an a) unextended and b) random coil.

A polymer with these properties can be envisaged as a disordered tangle of relatively compact random coils, as shown in Figure 2a. Because of their local mobility and lack of strong intermolecular attractions, the chains can be extended with essentially zero change in internal energy (Figure 2b). That they do not spontaneously revert to the stretched form is dictated by the entropy of the system. The elongated chains are more highly ordered than the random coils. In order to overcome the negative entropy effect, work must be performed to elongate the chains, and when the force is removed, the chains return to their disordered 'spaghetti-like' state. The polymer will usually not regain its original dimensions, unless there is some overall network structure, and this leads to another requirement:

3) To prevent long-range movements, the polymer chains must be joined at a few points (about once in every one hundred C-C linkages) by chemical bonds, usually via a short segment called a **cross-link**. Figure 1 shows a disulfide group connecting two poly(cis-isoprene) molecules. The development of the process of **vulcanization** which was discovered in 1839 independently by the Englishman Thomas Hancock and Charles Goodyear of the United States, made it possible to manufacture resilient rubber products, and led eventually to the large-scale usage of rubber in bicycle and automobile tires at the end of the nineteenth century. The fourth characteristic listed above (high modulus at full extention) accrues from another molecular property:

4) The molecular order brought about by the stretching process induces formation of crystalline regions within the polymer at high elongations. The crystallites act as physical cross-links and the stiffness is increased as a result.

The commercial importance of rubber became evident soon after the discovery of vulcanization, and scientific investigations of the product began shortly thereafter. The classical thermodynamics were studied by such masters as Lord Kelvin and Joule. In the 1920's and '30's the molecular interpretation was developed by early polymer chemists, such as Staudinger, Meyer, Kuhn, Guth and Herman Mark. The study of rubber elasticity provides an excellent opportunity to demonstrate the utility of statistical mechanics, as well as to review the basic relationships of classical thermodynamics.

In this experiment the dimensional properties of a rubber band will be studied using both a simple home-built apparatus and a Thermomechanical Analyzer. The data will be related to the change in entropy with elongation by the equations of classical thermodynamics. The results may also be used to validate the predictions of the statistical mechanical model of rubber elasticity and to calculate the number of active chain segments at the molecular level.

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This document originated from Professor Kathryn R. Williams